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EXAMINER	
HUISMAN, DAVID J	
ART UNIT	**PAPER NUMBER**
2183	

DATE MAILED: 11/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/689,257	BEAUMONT, MARK
	Examiner	Art Unit
	David J. Huisman	2183

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 August 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 August 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-26 have been examined.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: Power of Attorney as received on 5/2/2006 and Amendment as received on 8/18/2006.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 9-11, 19-20, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Hanounik et al., "Linear-Time Matrix Transpose Algorithms Using Vector Register File With Diagonal Registers," 2001 (herein referred to as Hanounik).

5. Referring to claim 1, Hanounik has taught a method for transposing data in a plurality of processing elements, comprising:

a) shifting the data along a plurality of diagonals of the plurality of processing elements until the processing elements in each of said plurality of diagonals has received the data held by every other processing element in that diagonal. See Fig.1, for instance, and note that data is shifted along at least two diagonals where each processing element in each diagonal receives data held

by every other element in that diagonal. For instance, a first diagonal would be the diagonal in the original matrix having a first element holding value 12 and another element holding value 21. After shifting, the first element in that diagonal holds 21 and the second element in that diagonal holds 12 (i.e. each element in the diagonal holds data held by the other element in the diagonal). Similarly, a second diagonal would be the diagonal in the original matrix having a first element holding value 78 and another element holding value 87. After shifting, the first element in that diagonal holds 87 and the second element in that diagonal holds 78 (i.e. each element in the diagonal holds data held by the other element in the diagonal).

b) selecting data as final output data based on a processing element's position. Clearly, looking at Fig.1, the element that originally holds value 12 should hold value 21 at the end of the transpose. The receiving of value 21, for instance, by the element in row 1, column 2, is the selection of that value by that element. It is further selected when it is outputted, as a value cannot be outputted unless it is first obtained/selected from memory or bus, or some other location. When it is finally selected, value 21 is outputted as the final data in the transpose.

6. Referring to claim 9, Hanounik has taught a method as described in claim 1. Hanounik has further taught that said shifting includes a combination of vertical and horizontal shifting. See Fig.1, and note, for example, that 21 ends up at a location one column over (horizontal shift) and one row up (vertical shifting) from its original location.

7. Referring to claim 10, Hanounik has taught a method as described in claim 1. Hanounik has further taught that said shifting includes a combination of shifting in the x and z directions. See Fig.1, and note, for example, that the value 21 ends up at a location one column over

(horizontal/x shift) and one row up (vertical/z shifting) from its original location. Horizontal and vertical (and x and z) are perpendicular directions (they form right angles with one another).

8. Referring to claim 11, Hanounik has taught a method for transposing data in an array of processing elements, comprising:

a) shifting the data along diagonals in the array a number of times equal to N-1 where N equals the number of processing elements in a diagonal. See Fig.1, for instance, and note that data is shifted along at least two diagonals. For instance, a first diagonal would be the diagonal in the original matrix having a first element holding value 12 and another element holding value 21. After shifting the first element holds 21 and the second element holds 12 (i.e. each element in the diagonal holds data held by the other element in the diagonal). In this example, there are 2 elements (N=2), and one (N-1) shift occurs. Note the single arrow between the two elements in Fig.1. This means that one shift (swap is occurring).

b) outputting data from each processing element as a function of that element's position in a diagonal. Clearly, looking at Fig.1, the element that originally holds value 12 should hold value 21 at the end of the transpose. When it finally does, value 21 is outputted as the final data in the transpose.

9. Referring to claim 19, Hanounik has taught a method as described in claim 11. Hanounik has further taught that said shifting includes a combination of vertical and horizontal shifting. See Fig.1, and note, for example, that the 21 ends up at a location one column over (horizontal shift) and one row up (vertical shifting) from its original location.

10. Referring to claim 20, Hanounik has taught a method as described in claim 11. Hanounik has further taught that said shifting includes a combination of shifting in perpendicular

directions. See Fig.1, and note, for example, that the value 21 ends up at a location one column over (horizontal shift) and one row up (vertical shifting) from its original location. Horizontal and vertical are perpendicular directions (they form right angles with one another).

11. Referring to claim 26, Hanounik has taught a computer-readable memory device carrying an ordered set of instruction which, when executed, perform a method (note that this is deemed inherent) comprising:

a) shifting the data along a plurality of diagonals of the plurality of processing elements until the processing elements in each of said plurality of diagonals has received the data held by every other processing element in that diagonal. See Fig.1, for instance, and note that data is shifted along at least two diagonals where each processing element in each diagonal receives data held by every other element in that diagonal. For instance, a first diagonal would be the diagonal in the original matrix having a first element holding value 12 and another element holding value 21. After shifting, the first element in that diagonal holds 21 and the second element in that diagonal holds 12 (i.e. each element in the diagonal holds data held by the other element in the diagonal). Similarly, a second diagonal would be the diagonal in the original matrix having a first element holding value 78 and another element holding value 87. After shifting, the first element in that diagonal holds 87 and the second element in that diagonal holds 78 (i.e. each element in the diagonal holds data held by the other element in the diagonal).

b) selecting data as final output data based on a processing element's position. Clearly, looking at Fig.1, the element that originally holds value 12 should hold value 21 at the end of the transpose. The receiving of value 21, for instance, by the element in row 1, column 2, is the selection of that value by that element. It is further selected when it is outputted, as a value

cannot be outputted unless it is first obtained/selected from memory or bus, or some other location. When it is finally selected, value 21 is outputted as the final data in the transpose.

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

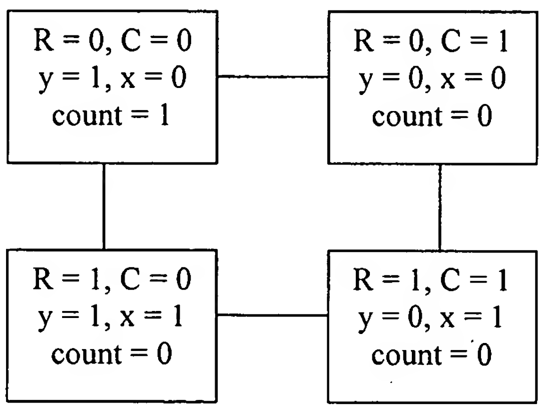
13. Claims 21-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Apisdorf et al., U.S. Patent No. 6,968,447 (herein referred to as Apisdorf).

14. Referring to claim 21, Apisdorf has taught a method for transposing data in a plurality of processing elements, comprising:

a) shifting data between processing elements arranged in diagonals. See Fig.3, 4A, 4B, and 6, column 13, lines 4-19, and column 14, lines 9-28. Note that elements are arranged in diagonals (i.e., as an array), and data is passed among them.

b) setting an initial count in each processing element according to one of the expressions: (x+y+1)MOD(array size), (C+R+1)MOD(array size), (C+y+1)MOD(array size), or (x+R+1)MOD(array size), where y and R are numbers indicating a row and a position in the row of a processing element and C and x are numbers indicating a column and a position in the column of a processing element. See column 13, lines 4-35, and column 14, lines 9-28. Each element has a counter which may be initialized to some value being zero or greater, which indicates the amount of code sections to process. In one given example, one processing element

has a counter initialized to 1 while the rest are initialized to 0 (column 13, lines 20-35). So, looking at Fig.4B, we could apply this example and say that one element's counter will be initialized to 1 while the rest are initialized to 0: So, in the following diagram each box represents a PE shown in Fig.4B having an initial count. The count is defined by multiple parameters. A first parameter is the array size 'S', where S=$\log_2$(amount of PEs). In Fig.4B, there are 4 elements. Consequently, the array size S= $\log_2(4)$, which yields S=2. Further parameters which define the count are those which specify a given PE's location in the array. These parameters (C, R, x, and y), and associated initial count, given S=2, are as follows:



The initial count for the top-left element in Fig.4B would be set to (C+R+1) MOD 2. This equals (0+0+1) MOD 2 = 1. The initial count for the top-right element in Fig.4B would be set to (C+R+1) MOD 2. This equals (1+0+1) MOD 2 = 0. The initial count for the bottom-left element in Fig.4B would be set to (C+R+1) MOD 2. This equals (0+1+1) MOD 2 = 0. And, the initial count for the bottom-right element in Fig.4B would be set to (x+y+1) MOD 2. This equals (1+0+1) MOD 2 = 0.

c) modifying the initial count by a programmable amount and at programmable intervals to produce a current count. See column 13, lines 4-35, and column 14, lines 9-28, and note that after each section is processed, the counter is decremented. So it is decremented by a programmable amount (1), and at a programmable interval (the amount of time to process a given section). Counters initialized to zero are incremented at some point before they are decremented.

d) selecting output data as a function of said current count. For as long as the counter is greater than zero, the element will execute instructions, which inherently produces output (where the output must be selected as output).

15. Referring to claim 22, Apisdorf has taught a method as described in claim 21. Apisdorf has further taught that said modifying includes counting down from said initial count. See column 13, lines 6-9.

16. Referring to claim 23, Apisdorf has taught a method as described in claim 22. Apisdorf has further taught that said selecting occurs when said current count is a non-positive value. See column 13, lines 6-9, and note that when the counter reaches 0 (non-positive), then the section that was executed to produce that non-positive value will produce data to be selected as output.

17. Referring to claim 24, Apisdorf has taught a method as described in claim 21. Apisdorf has further taught that said shifting includes a combination of vertical and horizontal shifting. See Fig.4A, 4B, and 6, and note that PEs are connected horizontally and vertically for data transfer.

18. Referring to claim 25, Apisdorf has taught a method as described in claim 21. Apisdorf has further taught that said shifting includes a combination of horizontal shifting. See Fig.4A,

4B, and 6, and note that PEs are connected. Looking at the connections, it can be seen that data may be passed east/west and north/south. Both of these can be looked at as horizontal shifting. North/south can be horizontal shifting because data is sent from one horizontal row to another, and east/west shifting is horizontal shifting because data is sent from an element to an element horizontal to that element.

Claim Rejections - 35 USC § 103

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

20. Claims 2-8 and 12-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hanounik, as applied above, in view of Apisdorf, as applied above.

21. Referring to claim 2, Hanounik has taught a method as described in claim 1. Hanounik has not explicitly taught one of loading an initial count into each processing element and calculating an initial count locally based on the processing element's location, said selecting being responsive to said initial count. However, Apisdorf has taught loading each element with an initial count, said selecting being responsive to said initial count. See column 13, lines 4-19, and column 14, lines 9-28. Each element has a counter which may be initialized to some value being zero or greater, which indicates the amount of code sections to process. Data will be selected for processing based on the counter. Such a counter allows for synchronization between processing elements. See column 13, line 45, to column 14, line 8. As a result, in order to

ensure synchronized communication between processing elements, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hanounik to include a counter taught by Apisdorf.

22. Referring to claim 3, Hanounik in view of Apisdorf has taught a method as described in claim 2. Apisdorf has further taught that said plurality of processing elements is arranged in an array and said initial count is given by one of the following expressions: (x+y+1)MOD(array size) (C+R+1)MOD(array size) (C+y+1)MOD(array size) or (x+R+1)MOD(array size). See column 13, lines 22-28. Note that the starting element's counter may be set to 1. If the starting element is the element in the 0^{th} row and 0^{th} column (top left element in the array shown in Fig.4A), then the initial value satisfies (C+R+1)MOD(array size), where R=0, C=0, and array size =8. This yields a count of 1. Also, no matter the initial value, it would meet the mod conditions set forth above. For instance, if the array size is 8, as in Fig.4A, and the counter is set to zero, then we can take x=0 and y=-1 so that we get 0 mod 8, which is zero (the initial value is zero). It should be noted that applicant has not defined x, y, C, and R, so they can be assigned any values.

23. Referring to claim 4, Hanounik in view of Apisdorf has taught a method as described in claim 2. Apisdorf has further taught maintaining a current count in each processing element, said current count being responsive to said initial count and the number of data shifts performed, said selecting being responsive to said current count. See column 13, lines 4-19, and column 14, lines 9-28. Counts are decremented based on the original count value each time data is shifted (and processed).

24. Referring to claim 5, Hanounik in view of Apisdorf has taught a method as described in claim 4. Apisdorf has further taught that said maintaining a current count includes altering said initial count at programmable intervals by a programmable amount. See column 13, lines 4-19, and column 14, lines 9-28, and note that after each section is processed, the counter is decremented. So it is decremented by a programmable amount (1), and at a programmable interval (the amount of time to process a given section).

25. Referring to claim 6, Hanounik in view of Apisdorf has taught a method as described in claim 4. Apisdorf has further taught that said initial count is decremented in response to said shifting of data to produce said current count. See column 13, lines 6-9.

26. Referring to claim 7, Hanounik in view of Apisdorf has taught a method as described in claim 4. Apisdorf has further taught that said selecting occurs when said current count is non-positive. See column 13, lines 6-9, and note that when the counter reaches 0 (non-positive), then the section that was executed to produce that non-positive value will produce data to be selected as output.

27. Referring to claim 8, Hanounik in view of Apisdorf has taught a method as described in claim 4. Hanounik has not taught maintaining a local count including setting a counter to a first known value, and counting up from said first known value based on the number of shifts that have been performed, said selecting occurring when a current count equals a target count. However, Apisdorf has taught such a concept. See column 14, lines 9-28. Each element has a counter which may be initialized to some value being zero or greater, which indicates the amount of code sections to process. Data will be selected for processing based on the counter. Such a counter allows for synchronization between processing elements. See column 13, line 45, to

column 14, line 8. As a result, in order to ensure synchronized communication between processing elements, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hanounik to include a counter taught by Apisdorf.

28. Referring to claim 12, Hanounik has taught a method as described in claim 11. Furthermore, claim 12 is rejected for the same reasons set forth in the rejection of claim 2.

29. Referring to claim 13, Hanounik in view of Apisdorf has taught a method as described in claim 12. Furthermore, claim 13 is rejected for the same reasons set forth in the rejection of claim 3.

30. Referring to claim 14, Hanounik in view of Apisdorf has taught a method as described in claim 12. Furthermore, claim 14 is rejected for the same reasons set forth in the rejection of claim 4.

31. Referring to claim 15, Hanounik in view of Apisdorf has taught a method as described in claim 14. Furthermore, claim 15 is rejected for the same reasons set forth in the rejection of claim 5.

32. Referring to claim 16, Hanounik in view of Apisdorf has taught a method as described in claim 14. Furthermore, claim 16 is rejected for the same reasons set forth in the rejection of claim 6.

33. Referring to claim 17, Hanounik in view of Apisdorf has taught a method as described in claim 16. Furthermore, claim 17 is rejected for the same reasons set forth in the rejection of claim 7.

34. Referring to claim 18, Hanounik in view of Apisdorf has taught a method as described in claim 12. Furthermore, claim 18 is rejected for the same reasons set forth in the rejection of claim 8.

Response to Arguments

35. Applicant's arguments filed on August 18, 2006, have been fully considered but they are not persuasive.

36. Applicant argues the novelty/rejection of claim 1 on page 13 of the remarks, in substance that:

> "The method illustrated in Figure 1 of Hanounik appears substantially different from applicant's method. Figure 1 B shows the matrix after the first stage of transposition. It appears that the matrix is divided into four quadrants, and the data of the lower left-hand and upper right-hand quadrants are swapped. Thereafter, the matrix is again divided into quadrants, and the data in certain quadrants data swapped as shown. Finally, in Fig. 1 D, it appears that data are swapped between certain processing elements as shown. The method in Fig. 1 of Hanounik thus involves the swapping of data quadrant by quadrant rather than the shifting of data along a plurality of diagonals until the processing elements in each of the plurality of diagonals has received the data held by every other processing element in that diagonal."

37. These arguments are not found persuasive for the following reasons:

a) Even if Hanounik performs swapping among quadrants, for the plurality of diagonals specifies in the rejection, this is equivalent to shifting (as far as the claim is concerned). For example, looking at the diagonal containing the values 12 and 21, by swapping these values, the data is shifted from one element to the other and vice-versa such that each element in that diagonal receives data held by every other element in that diagonal.

38. Applicant argues the novelty/rejection of claim 1 on pages 13-14 of the remarks, in substance that:

> "Secondly, the examiner states that "the element that originally holds value 12 should hold value 21 at the end of the transpose. When it finally does, value 21 is outputted as the final data in the transpose." It appears, however, that the data in each processing element at the end of the process is the data to be output. There is no need for the processing elements to select from amongst all of the data which they have received which data to output, i.e., no selecting of data as final output based on position."

39. These arguments are not found persuasive for the following reasons:

a) The selecting is an essential part in the outputting. Clearly, data must be obtained/selected from some memory or from some location within the system so that it may be outputted (because data must be stored somewhere or else it will simply decrease in strength over time and become nothing). The 2nd element in the first row will select data 12 for output.

40. A similar argument has been made regarding the Apisdorf rejection of claim 21, on page 14 of the remarks, in that Apisdorf does not select output data as a function of said current count. As stated in the rejection, the code that is executed based on the count clearly produces output. Output must be selected as output. That is, the system must decide what to output, select it for transmission on an output bus, and then output it.

41. Applicant argues the novelty/rejection of claim 21 on page 15 of the remarks, in substance that:

> "It is clear from the foregoing that the examiner is simply picking and choosing those portions of the reference favorable to his case, while ignoring other teachings of the reference which undercut the examiner's position. Although claim 21 has been amended to define x, y, C, and R, it is apparent that when Apisdorf is considered for all that it teaches, Apisdorf does not anticipate claim 21."

42. These arguments are not found persuasive for the following reasons:

a) Regarding picking and choosing, the examiner disagrees. In fact, the exact portion that applicant pointed out in the arguments as being something the examiner ignored is now being

relied upon in the rejection. The portion cited by applicant shows an example of initializing counters for processing elements and it is not clear how this undermines the examiner's position. The reason this portion was not cited before was because the examiner felt that the portions of Apisdorf cited in the rejection of claim 21 were enough to make the rejection.

Conclusion

43. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David J. Huisman whose telephone number is (571) 272-4168. The examiner can normally be reached on Monday-Friday (8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DJH
David J. Huisman
October 25, 2006

EDDIE CHAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100